Citizen Science and Chemistry

Division of Environmental Chemistry
American Chemical Society
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Organizers: William Batschelet, Sherine Obare, Elke Schoffers

Presiders: William Batschelet, Sherine Obare

Presenting Author	**Title**
William Batschelet	Introductory Remarks
Deb Szaro	Citizen Science: Empowering communities and engaging regulators
Walter Shortle	Maple producers play key role in use of tree sap to monitor tree health in a changing environment
Shannon Bartelt-Hunt	Citizen Science as a Quantitative Tool for Temporal and Spatial Water Quality Assessment
Antony Williams	Data review and clean-up using crowdsourced input via the US EPA CompTox Chemistry Dashboard.
	Intermission
Elke Schoffers	From polymath to specialist and the making of unscientific America. Why should chemists care about citizen science?
Douglas Kriner	Activating Public Support for Science: Educating Citizens for Science
Keith Peterman	Real world narrative risk framing for the benefit of Earth and its people
Gregory Foy	An eCLEAR Interactive Climate Science Literacy Tool
Jerry Bell	Science citizen credibility in a climate disrupted world
Bassam Shakhashiri	Citizen science…for the benefit of Earth and its people
	Panel Discussion

Let's start by fleshing out the definition of citizen science a little more-

In **citizen science**, the public participates voluntarily in the scientific process, addressing real-world problems in ways that may include formulating research questions, conducting scientific experiments, collecting and analyzing data, interpreting results, making new discoveries, developing technologies and applications, and solving complex problems.

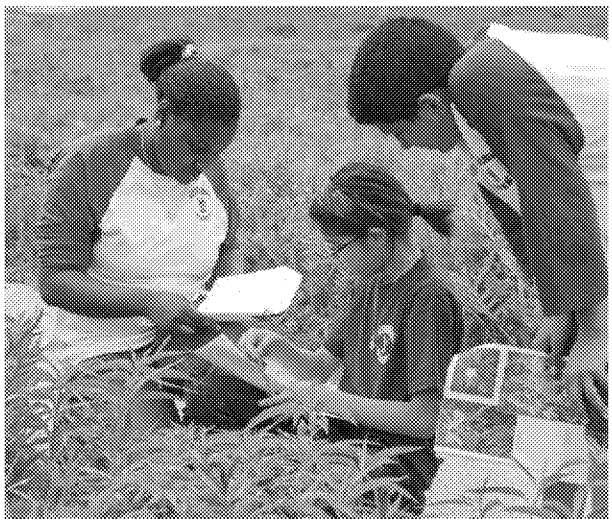
I also want to talk about crowdsourcing. It often goes hand-in-hand with citizen science.

In **crowdsourcing**, organizations submit an open call for voluntary assistance from a large group of individuals for online, distributed problem solving.

These concepts are not new to federal agencies. We, at EPA, have had water quality monitoring collaboratives for decades. And now we have sensor technologies that are revolutionizing the way environmental data are being generated – the quantity of data but not necessarily the quality.

Environmental Protection Belongs to the Public

A Vision for Citizen Science at EPA



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program and regional activities. Successful citizen science programs and partnerships that harness the public's energy and creativity exist across the country and the world and provide real benefits, including increased public understanding of environmental science, direct connections with individuals and communities, and new contributions to environmental and health research.

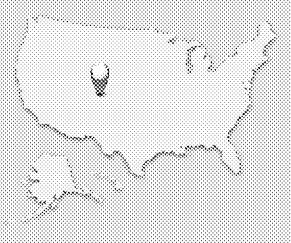
Citizen science goes beyond data collection by including and valuing other ways of knowing, such as traditional ecological knowledge, lay and local knowledge, and stories. A scientifically informed and engaged public is vitally important for effective governmental policy making, and citizen science can enhance EPA's approach to connecting its mission to the American people.

Table 1. Benefits of EPA Support for Citizen Science

Benefits of Citizen Science
Engaged Communities. An educated and engaged public that can support EPA in solving environmental and health problems.
Collaborative Governance. Energized and improved environmental governance created through generating deep public involvement in EPA priorities and monitoring practices.
Common Vision. A public connected to and invested in the missions of federal agencies by promotion of open government, civic participation and volunteerism.
Actionable Information. Contributions to environmental and health research that would otherwise be impossible, including data and information to fill current gaps, early warning of environmental issues and problems, and information on problems not adequately covered by monitoring networks.
Shared Knowledge. The advancement and acceleration of scientific research through collaborative practices bounded in group discovery, learning and the co-creation of knowledge.
Accessible Technology. Technology that is open sourced to promote rapid iterations and advancements in support of environmental priorities.
Environmental Literacy. The advancement of national priorities around science, technology, engineering, arts and mathematics (commonly known as STEAM) education through citizen science activities.

Colorado River Watch

Location and Dates: Statewide (all groups have same equipment, protocols and training), 1989 to present



Groups Involved: Annually serves 140 groups (85% schools and 15% adult citizen)

Also an Example of: Community engagement, education, management, regulatory decisions

Budget: $250,000 but saves an estimated $1.3 million per year

IN BRIEF

Topic: Water quality, habitat assessment, biodiversity

Scale: Statewide

Participants: Anyone

Data uses: Regulatory standard setting, community engagement, education, management, regulatory decisions

Summary: Colorado River Watch—a partnership between Colorado Parks and Wildlife, citizens and a nonprofit organization—annually provides equipment, training, support and sample analyses for 140 groups, which in turn monitor more than 650 locations monthly for chemical (e.g., metals and nutrients) and annual macroinvertebrate and physical habitat assessment. The program directly reaches 2,000 individuals and indirectly reaches 15,000 individuals every year. In comparison, the Colorado Clean Water Act Agency has the ability to fund 40 annual stations to cover more than 700,000 miles of Colorado streams. Colorado River Watch uses the same field and laboratory methods as the Colorado Clean Water Act Agency. Primary uses of the data collected include decision processes, such as standard development and setting, use assessment, impaired stream listing/delisting, development and monitoring of total maximum daily loads, and nonpoint source project monitoring.

The Colorado Clean Water Act Agency conducts an annual data call to evaluate use attainment and update designated uses assigned to specific water bodies. Colorado River Watch data have more temporal and geographic coverage than any other data provider—often being the only data available for a water body—that can be used in these regulatory standard setting hearings. Colorado River Watch macroinvertebrate data are used to calibrate multimetric indexes used for aquatic life use impairment and to determine use attainment. Colorado River Watch has a 27-year history of providing data for these regulatory standard hearings.

Colorado River Watch also provides baseline and postmonitoring data for regulatory and nonregulatory standard and goal setting for remediation projects, fish kills, environmental spills and Superfund efforts. For example, Colorado River Watch data have been used since 1990 on the Animas River in six standard setting hearings, evaluating attainment and then directing remediation efforts in the basin. Colorado Parks and Wildlife uses the data for fishery management, native species introduction, stream restoration and invasive species efforts. Others use the data, network and program for watershed management activities, education, community engagement, nonregulatory decisions and data acquisition. Colorado Parks and Wildlife uses the program to protect fisheries, leverage resources, strategically collaborate to achieve mission goals, provide outdoor experiences, educate, and enhance public relations. Baseline data are essential to determine baseline conditions and goals for reclamation projects and after floods, fires and environmental spills. This program collects more data than any other entity in Colorado and has the most volunteer monitoring data in EPA's national water quality database, STORET, and in the Water Quality Portal. The state of Colorado and others depend on this program for statewide baseline data coverage for rivers. As such, the Colorado Clean Water Act Agency is working on a plan to utilize this program for ambient water quality monitoring and focusing scarce resources on targeted monitoring.

More information: cpw.state.co.us/aboutus/Pages/RiverWatch.aspx

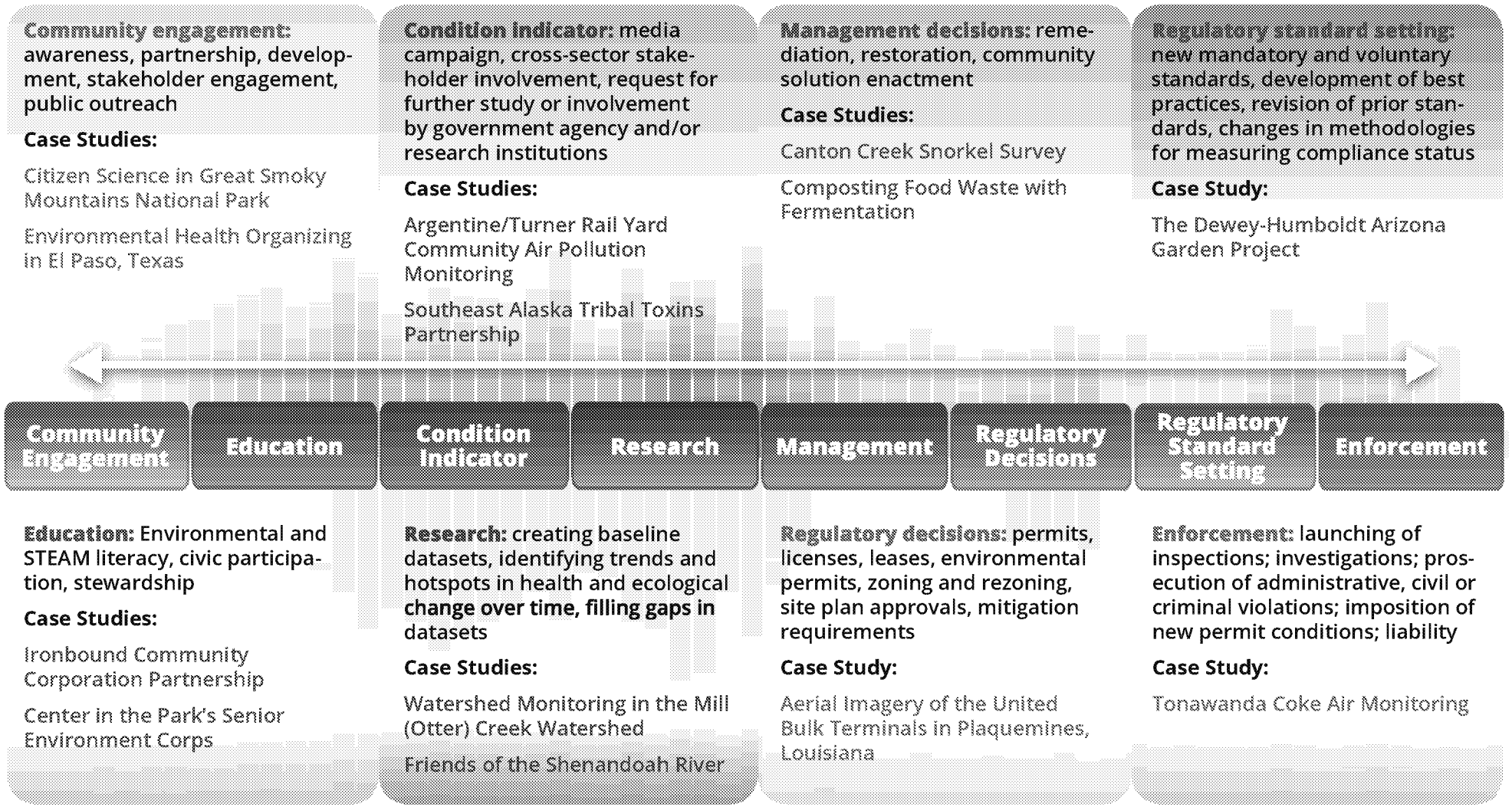


Figure 1. The spectrum of citizen science data use.

Case studies illustrate the range of ways that EPA can integrate citizen science into EPA's work, from engaging communities in environmental protection to using citizen science data for enforcement action. These examples address community engagement, education, condition indicators, research, management, regulatory decisions, regulatory standard setting and enforcement across the spectrum of data uses.

projects. The memorandum encourages agencies to build and support citizen science by developing

Citizen Science at EPA: Past and Present